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ENGINEERING DESIGN FILE

Project/Task: WAG 7 RI/FS DATA TASK

Subtask: Air Monitoring Data

TITLE: Air Monitoring Data Supporting WAG 7 RI/FS

Summary:

This EDF compiles data and describes data sources for use in the air pathway risk assessment at the RWMC. Data reported here include those from routine monitoring and from special studies of fugitive emissions, and meteorological data necessary to perform atmospheric dispersion modeling of those emissions. Excluded from this EDF are point source emissions data.

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		EG&G Review	Date	EG&G Approval	Date

INTRODUCTION

This EDF compiles data and describes data sources for use in the air pathway risk assessment at the RWMC. Data reported here include those from routine monitoring and from special studies of fugitive emissions, and meteorological data necessary to perform atmospheric dispersion modeling of those emissions. Excluded from this EDF are point source emissions data, such as emissions from the Drum Venting Facility.

ROUTINE MONITORING

The Environmental Monitoring Unit of LITCO monitors ambient air at the RWMC (and other INEL facilities) for radioactive particulates. The 1983 Monitoring Activities Review (EG&G, 1983) provides much of the rationale for the current ambient air monitoring design. There are six air sampling locations along the perimeter of the Subsurface Disposal Area (SDA), and six more within the Transuranic Storage Area (TSA) (Figure 1). A control low-volume air sampler is located near Experimental Breeder Reactor-1. Monitoring of PM_{10} (particulate matter smaller than 10 μm diameter, which includes the respirable fraction) was initiated in July 1992, and PM_{10} samplers have replaced the original low volume samplers at most locations. The PM_{10} samplers operate at 4 cfm and collect the sample on a filter.

LITCO air filter samples are collected and analyzed semimonthly for gross alpha and beta activity, and monthly composites at each location are analyzed quantitatively for gamma-emitting radionuclides. Selected filters are also composited quarterly and analyzed for specific alpha- and beta-emitting radionuclides (Am-241, Pu-238, Pu-239, Pu-240, U-235, U-238, and Sr-90). It should be noted that measured activities are rarely above detection limits for specific radionuclides (but see below). Gross alpha data are used primarily to screen for TRU alpha-emitters, particularly Pu-239 and Am-241. Gross beta measurements serve as an indicator of overall radioactivity concentrations in the air. A quality assurance program, developed to ensure representative sampling methods and to verify the quality of reported results, is integrated into the monitoring program (EG&G, 1988).

Data are reported annually (e.g., Wilhelmsen et al., 1993); however, data are presented graphically and therefore are not usable for modeling purposes. Raw air monitoring data reside in a Novell file server which is accessed through FOXPRO software. An account is required for access; contact Bob Bates, LITCO, System Administrator.

A single low-volume sampler located outside the fence northeast of TSA (as well as eleven other onsite, seven boundary, and four distant samplers) is operated by the Environmental Science and Research Foundation [ESRF; formerly Radiological and Environmental Sciences Laboratory (RESL)]. Filters from this sampler are analyzed weekly for gross gamma, gross alpha, and gross beta. Quarterly composites are analyzed for specific radionuclides. Results are reported in annual reports such as Mitchell, 1994. Gross alpha and gross beta data for the recent past are summarized in Tables 1 and 2. ESRF maintains quality control and assurance programs, which are outlined in annual reports (e.g., Mitchell, 1994).

In 1993 Am-241 was "indicated" in ESRF's second quarterly composite, and Pu-239/240 in the third quarterly composite, at $(5\pm4) \times 10^{-18}$ μCi/mL and $(4.2\pm3.2) \times 10^{-18}$ μCi/mL, respectively. Occurrence of these radionuclides near detection limits may have been due to construction activities disturbing soil known to have above-background concentrations of americium and plutonium.

NONRADIOACTIVE, HAZARDOUS EMISSIONS ESTIMATES

No routine monitoring is presently conducted for airborne nonradiological, hazardous materials. Crockett (1983) measured VOCs and other hazardous materials in fine-grained surface soils at the RWMC, and concluded that there was no evidence for migration from buried wastes to surface soils. Subsequent discovery of VOCs in soil gas lead Sisson and Porro (1992) to recommend supplementing the existing monitoring program with VOCs sampling; to date, this recommendation has not been acted upon.

One special study was recently conducted on VOC emissions from SDA surface soil. Flux chamber measurements were taken at 12 locations on the SDA (Figure 2) on two consecutive days in the winter, and two consecutive days in the summer (Schmidt, 1993; 1994). Results of those measurements are summarized in Table 3.

METEOROLOGICAL DATA

Meteorological data are collected by NOAA at 10 m elevation at the RWMC. Although data have been collected for several years, problems with the wind instruments were discovered in 1992, invalidating previous data. 1994 data are the first full year's worth of recent, valid wind speed and direction data; these data are presented in Table 4. If five-year average wind data are required for modeling, it is recommended by NOAA that CFA wind data for the past five years be used. Wind files for use in the CAP-88 radiological assessment code have been documented (Leonard, 1992; 1995), and these are also recommended for use in other codes, where applicable.

Other variables potentially needed for atmospheric dispersion modeling are shown in Table 5. One variable which has not, to date, been adequately studied at the INEL is mixing, or lid height. A value of 800 m is recommended by NOAA until studies can be conducted to justify changing this value.

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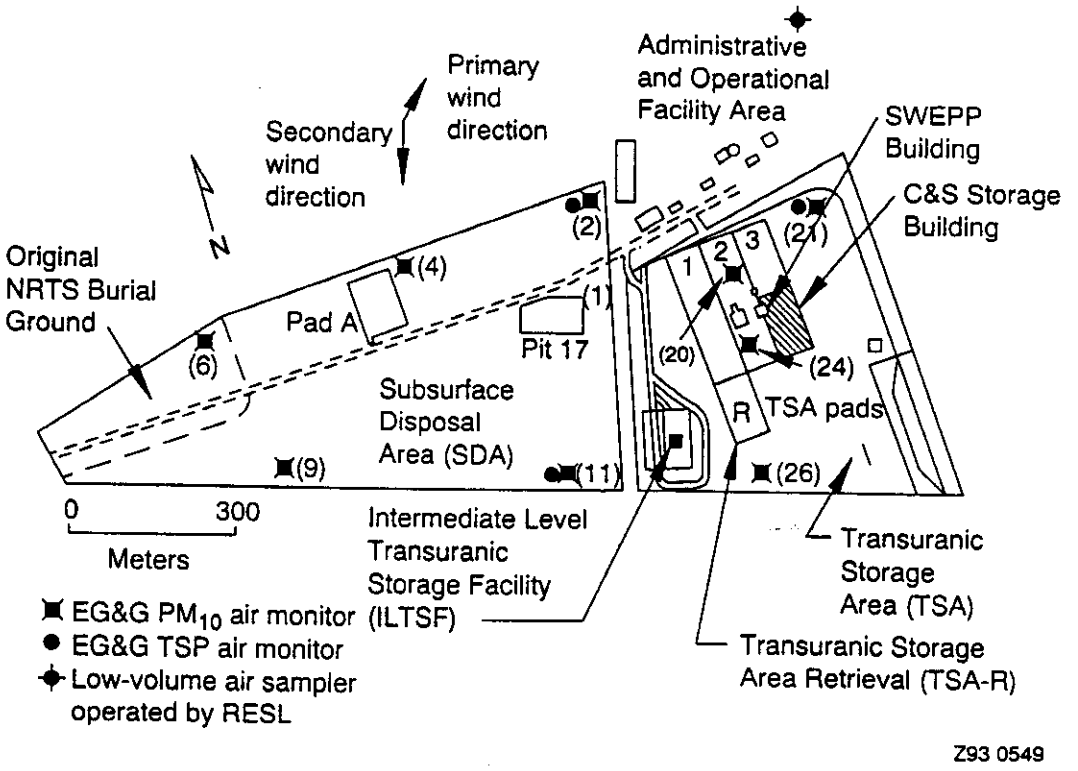

Figure 1. The RWMC, showing locations of air monitors.

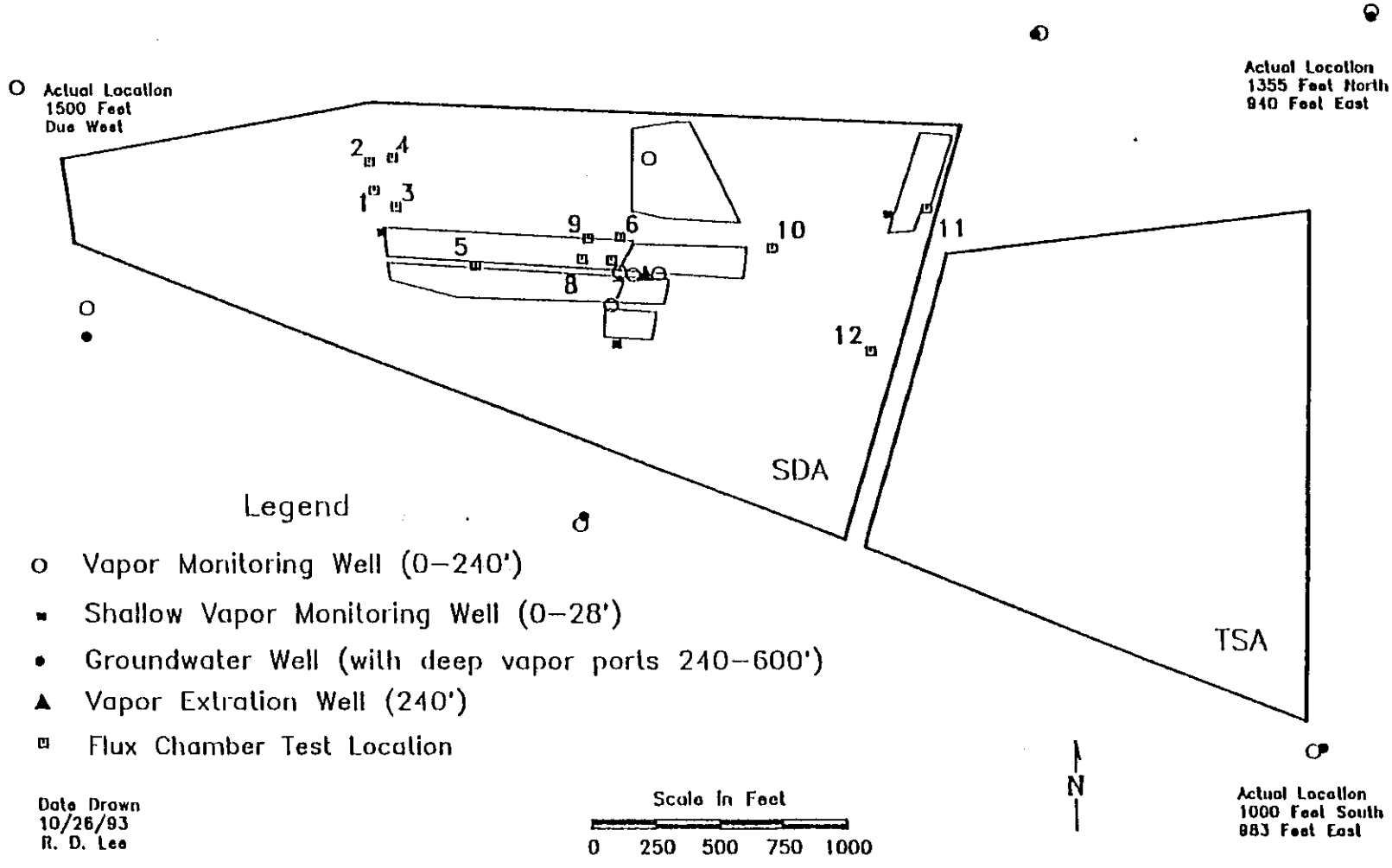

Figure 2. Locations of soil flux emission rate measurements at the RWMC.

Table 1. Gross alpha activity in air (x 10^{-15} μCi/mL) as measured by ESRF.[a]

YEAR	LOCATION	NUMBER of SAMPLES	RANGE of SAMPLES	ANNUAL MEAN
1990	RWMC	50	0.4-3.7	1.59±0.18
	Boundary	101	0.5-4.9	1.73±0.13
	Distant	101	0.3-6.3	1.62±0.16
1991	RWMC	51	0.5-2.8	1.72±0.16
	Boundary	104	0.6-4.0	1.77±0.11
	Distant	101	0.4-4.3	2.03±0.16
1992	RWMC	53	0.3-2.6	1.27±0.15
	Boundary	105	0.04-3.7	1.66±0.12
	Distant	106	0.05-3.4	1.56±0.14
1993	RWMC	50	0.2-4.4	1.5±0.2
	Boundary	101	0.3-4.1	1.8±0.2
	Distant	103	0.1-4.1	1.5±0.1

a. Sources: DOE, 1991; 1992; 1993; Mitchell, 1994

Table 2. Gross beta activity in air (x 10^{-15} μCi/mL) as measured by ESRF.[a]

YEAR	LOCATION	NUMBER of SAMPLES	RANGE of SAMPLES	ANNUAL MEAN
1989	RWMC	50	10-74	31±4
	Boundary	363	7-117	30±1
	Distant	203	7-97	28±2
1990	RWMC	50	6-102	27±4
	Boundary	361	4-107	27±1
	Distant	204	5-100	26±2
1991	RWMC	51	6-63	28±3
	Boundary	362	-2-77	28±1
	Distant	204	4-71	27±1
1992	RWMC	53	9-43	22±2
	Boundary	363	8-62	26±1
	Distant	205	8-51	25±1
1993	RWMC	50	7-87	25±4
	Boundary	356	7-104	26±2
	Distant	198	7-87	25±2

a. Sources: DOE, 1990; 1991; 1992; 1993; Mitchell, 1994

Table 3. Summary of emission rate data from flux chamber measurements ($\mu g/m^2$-min) on the SDA[a].

CHEMICAL	SUMMER				WINTER			
	n[b]	RANGE	MEAN[c]	S.D.	n[b]	RANGE	MEAN	S.D.
Acetone	25	0.37-6.4	1.36	1.27	11	0.53-3.7	1.92	0.85
Chloroform	14	0.52-7.9	3.77	2.08	9	0.36-4.3	1.74	1.49
1,1,1-TCA	9	0.52-2.6	1.30	0.56	10	0.38-1.9	1.14	0.52
Carbon Tetrachloride	14	2.1-110	46.2	30.6	16	0.70-38	10.3	11.7
Trichloroethylene	12	0.56-28	12.7	7.58	9	0.3-7.2	4.34	2.85
Tetrachloroethylene	13	1.9-14	6.18	4.05	12	0.49-3.1	1.53	1.05
Methylene Chloride	NONE DETECTED				8	0.17-1.2	0.54	0.40
2-Butanone	2	0.43-0.47	0.45	0.028	4	0.24-0.37	0.32	0.055
Toluene	NONE DETECTED				3	0.32-0.70	0.50	0.19
Dichlorodifluoro-methane	5	0.34-4.0	1.11	1.61	NONE DETECTED			
1,2-Dichloropropane	1	--	0.34	--	NONE DETECTED			

a. Sources: Schmidt, 1993; 1994 for winter and summer, respectively.
b. Number of samples with detectable concentrations of chemical.
c. Arithmetic mean.

Table 4. RWMC 1994 wind data (NOAA STAR file) .

WIND DIRECTION	STABILITY CLASS	FREQUENCY BY WIND SPEED CLASS					
		1	2	3	4	5	6
N	A	0.00132	0.00069	0	0	0	0
NNE	A	0.00132	0.0024	0	0	0	0
NE	A	0.0012	0.00377	0	0	0	0
ENE	A	0.00192	0.0064	0	0	0	0
E	A	0.00132	0.00549	0	0	0	0
ESE	A	0.0018	0.0048	0	0	0	0
SE	A	0.00228	0.00389	0	0	0	0
SSE	A	0.0018	0.00446	0	0	0	0
S	A	0.00264	0.00606	0	0	0	0
SSW	A	0.00228	0.00754	0	0	0	0
SW	A	0.00324	0.00366	0	0	0	0
WSW	A	0.00276	0.00297	0	0	0	0
W	A	0.00144	0.00217	0	0	0	0
WNW	A	0.00156	0.00114	0	0	0	0
NW	A	0.00156	0.00034	0	0	0	0
WNW	A	0.00024	0.0008	0	0	0	0
N	B	0	0.00023	0.00023	0	0	0
NNE	B	0.00013	0.00126	0.0008	0	0	0
NE	B	0.00013	0.00274	0.00137	0	0	0
ENE	B	0.00027	0.00309	0.00217	0	0	0
E	B	0.0004	0.00103	0.00069	0	0	0
ESE	B	0.00013	0.00069	0.00011	0	0	0
SE	B	0.00027	0.00057	0.00057	0	0	0
SSE	B	0.00013	0.00069	0.00046	0	0	0
S	B	0	0.00137	0.00103	0	0	0
SSW	B	0.00013	0.00171	0.0024	0	0	0
SW	B	0.00067	0.00183	0.0024	0	0	0
WSW	B	0.00108	0.00206	0.0008	0	0	0
W	B	0.0004	0.00114	0.00091	0	0	0
WNW	B	0	0.00011	0.00046	0	0	0
NW	B	0	0	0.00011	0	0	0
WNW	B	0	0.00023	0.00011	0	0	0
N	C	0	0	0.00069	0.00011	0	0
NNE	C	0.00025	0.00091	0.00137	0.00023	0	0
NE	C	0.0005	0.0032	0.00411	0.00011	0	0
ENE	C	0	0.00251	0.00457	0.00046	0	0
E	C	0.00025	0.00057	0.00103	0	0	0
ESE	C	0	0	0.00034	0	0	0
SE	C	0	0.00034	0.00023	0	0	0
SSE	C	0	0.00023	0.00046	0	0	0
S	C	0.00012	0.00057	0.00149	0.00011	0	0
SSW	C	0.00062	0.00034	0.00766	0.00057	0	0
SW	C	0.00074	0.0016	0.00811	0.00103	0	0
WSW	C	0.00062	0.00091	0.00309	0.00034	0	0
W	C	0.00025	0.00069	0.0016	0.00023	0	0
WNW	C	0.00062	0.00023	0.00057	0.00011	0	0
NW	C	0	0	0.00023	0.00023	0	0
WNW	C	0	0	0.00091	0.00011	0	0

N	D	0.00037	0.00183	0.00126	0.00137	0.00046	0.00023
NNE	D	0.00049	0.00686	0.00663	0.00389	0.0008	0.00011
NE	D	0.00025	0.02057	0.03189	0.01497	0.00514	0.00023
ENE	D	0.00037	0.00891	0.00971	0.00811	0.00103	0.00011
E	D	0.00025	0.00217	0.00229	0.0008	0	0
ESE	D	0	0.00069	0.00069	0.00034	0	0
SE	D	0.00012	0.00149	0.00206	0.00034	0	0
SSE	D	0	0.00069	0.00171	0.00126	0.00046	0
S	D	0.00025	0.00137	0.0016	0.00149	0.00034	0
SSW	D	0.00037	0.00766	0.02091	0.02491	0.0064	0.00057
SW	D	0.00136	0.01463	0.04046	0.06446	0.03269	0.01486
WSW	D	0.00358	0.01669	0.01451	0.01783	0.01817	0.02011
W	D	0.00519	0.00914	0.0064	0.00331	0.00103	0.00046
WNW	D	0.00099	0.00274	0.00194	0.00183	0.00011	0.00034
NW	D	0	0.00126	0.00194	0.00183	0.00011	0.00011
WNW	D	0.00037	0.00103	0.00057	0.00057	0.00011	0
N	E	0.00023	0.00194	0.00046	0	0	0
NNE	E	0.00069	0.00526	0.004	0	0	0
NE	E	0.00103	0.00869	0.00903	0	0	0
ENE	E	0.00046	0.00411	0.00297	0	0	0
E	E	0.00023	0.00171	0.00091	0	0	0
ESE	E	0	0.00114	0.00046	0	0	0
SE	E	0.00011	0.0008	0.00114	0	0	0
SSE	E	0.00011	0.00091	0.00057	0	0	0
S	E	0.00011	0.0008	0.00023	0	0	0
SSW	E	0.00046	0.00366	0.01314	0	0	0
SW	E	0.00172	0.00857	0.0192	0	0	0
WSW	E	0.00402	0.00937	0.0048	0	0	0
W	E	0.00805	0.01131	0.00217	0	0	0
WNW	E	0.00195	0.00309	0.0008	0	0	0
NW	E	0.00046	0.0008	0.00046	0	0	0
WNW	E	0	0.00091	0	0	0	0
N	F	0.00344	0.00514	0	0	0	0
NNE	F	0.00499	0.00457	0	0	0	0
NE	F	0.00428	0.00457	0	0	0	0
ENE	F	0.00333	0.004	0	0	0	0
E	F	0.00273	0.0032	0	0	0	0
ESE	F	0.00119	0.00137	0	0	0	0
SE	F	0.00154	0.00263	0	0	0	0
SSE	F	0.0038	0.00217	0	0	0	0
S	F	0.00285	0.00206	0	0	0	0
SSW	F	0.0044	0.00423	0	0	0	0
SW	F	0.00736	0.0072	0	0	0	0
WSW	F	0.01307	0.01097	0	0	0	0
W	F	0.01675	0.01086	0	0	0	0
WNW	F	0.00974	0.00709	0	0	0	0
NW	F	0.00523	0.00423	0	0	0	0
WNW	F	0.00511	0.00377	0	0	0	0

Table 5. Values for input variables for atmospheric dispersion models.

VARIABLE	VALUE	SOURCE
Annual Average Temperature	6 C	NOAA
Average Annual Rainfall	21 cm/yr	NOAA
Mixing Height	800 m	NOAA
Surface Soil Resuspension Rate Constant	5.8E-12/s	DOE, 1994
Respirable Fraction of Resuspended Surface Soil	50%	EPA[a]

a. This is a conservative value recommended by EPA when converting from TSP to PM-10.